Figure S1: Degradation rate of degradable membrane used in this study.

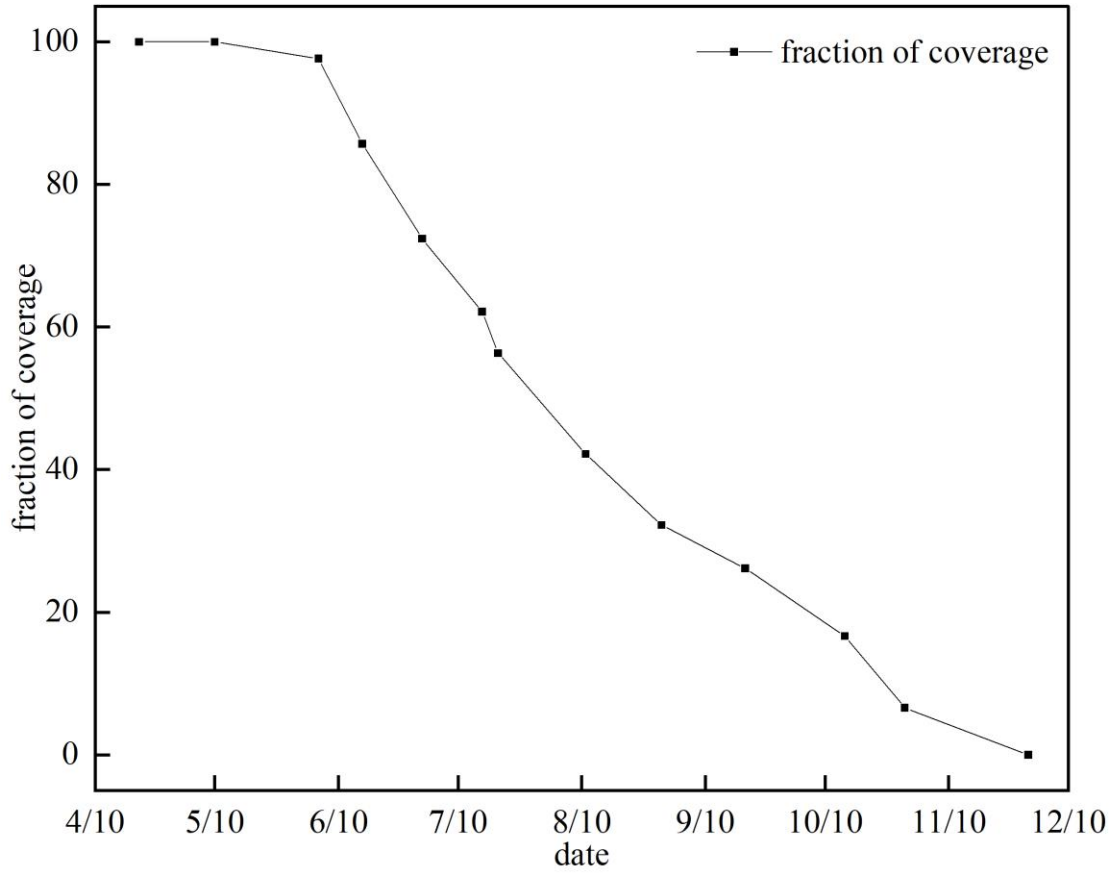


Figure S2. Average daily temperature and average annual precipitation in the Loess Plateau from 1990 to 2019.（The baseline period in this study is 1981-2010, unfortunately, we have selected the average rainfall and average temperature for the 30 years from 1990-2019 to represent the climatic conditions in the Loess Plateau region, as meteorological stations were not established in some counties in the Loess Plateau region before 1990, and therefore meteorological data are not available for each county.）.

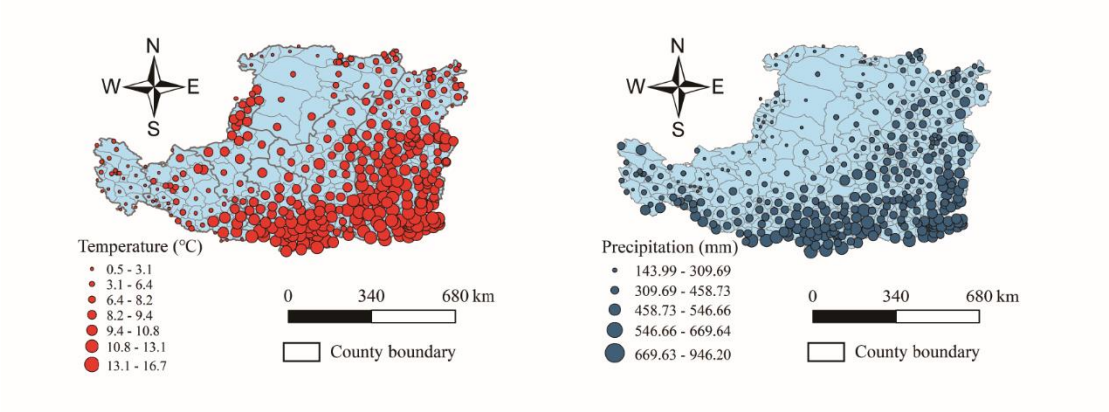


Figure S3. Structure of the DNDC model.

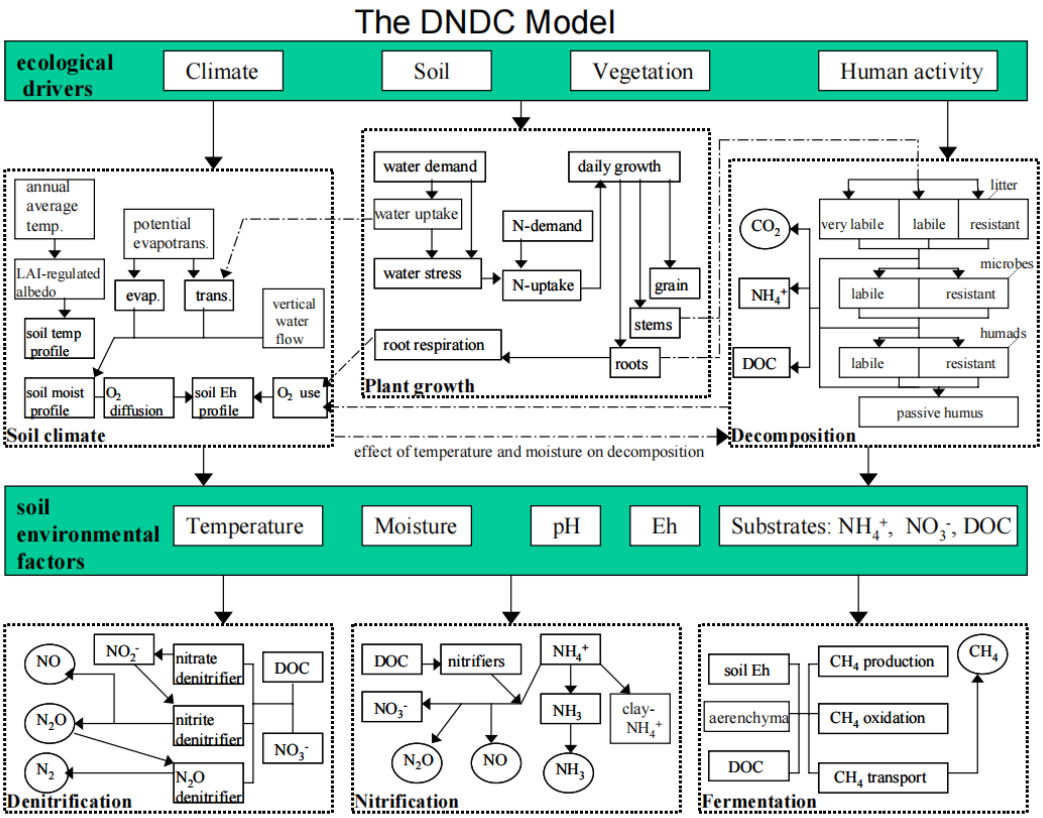


Table S1. List of 21 global climate models (GCM) used in this study.

Name of GCM	Abbreviation	Institute ID	Resolution	Country
ACCESS-CM2	ACC1	CSIRO and BoM	1.25°×1.88°	Australia
ACCESS-ESM1-5	ACC2	CSIRO and BoM	1.25°×1.88°	Australia
BCC-CSM2-MR	BCCC	BCC	1.11°× 1.13°	China
CanESM5	Can1	CCCMA	2.77°×2.81°	Canada
CanESM5-CanOE	Can2	CCCMA	2.77°×2.81°	Canada
CNRM-ESM2-1	CNR1	CNRM	1.39°×1.41°	France
CNRM-CM6-1	CNR2	CNRM	1.39°×1.41°	France
CNRM-CM6-1-HR	CNR3	CNRM	0.49°×0.50°	France
EC-Earth3	ECE1	EC-EARTH	0.7°×0.7°	Europe
EC-Earth3-Veg	ECE2	EC-EARTH	0.7°×0.7°	Europe
FGOALS-g3	FGOA	FGOALS	5.18°×2.00°	China
GFDL-ESM4	GFD2	GFDL	1.00°×1.25°	United States
GISS-E2-1-G	GISS	GISS	2.0°×2.5°	United States
INM-CM4-8	INM1	INM	1.5°×2.0°	Russia
INM-CM5-0	INM2	INM	1.5°×2.0°	Russia
IPSL-CM6A-LR	IPSL	IPSL	1.3°×2.5°	France
MIROC6	MIR1	MIROC	1.38°×1.41°	Japan
MPI-ESM1-2-HR	MPI1	MPI	0.93°×0.94°	Germany
MPI-ESM1-2-LR	MPI2	MPI	1.85°×1.88°	Germany
MRI-ESM2-0	MTIE	MRI	1.11°×1.13°	Japan
UKESM1-0-LL	UKES	MOHC	1.25°×1.87°	UK

S1. Sensitivity analysis

In order to determine the most important factors that influenced the maize yield under different mulching conditions, sensitivity analysis was conducted using the DNDC model, where the partial input parameters for the simulations were quantitatively analyzed based on the Monte Carlo method. The simulation in 2015 was more representative of the multi-year average climatic conditions in the test area, so this period was selected as the basic scenario. The two input parameters of temperature and precipitation are analyzed. The sensitivity analysis adopts single factor simulation analysis, that is, one input parameter is selected each time, and the random fluctuation simulation is conducted 400 times within its reasonable range (base value ± 30%). Other input parameters remain unchanged. and the sensitivity index (SI) (Equation (S1)) was used to measure the effects of the selected input parameters on the corn farmland productivity.

$$SI = \frac{(R_{max} - R_{min}) / \bar{R}}{(I_{max} - I_{min}) / \bar{I}} \quad (S1)$$

where I_{max}, I_{min}, and I are the minimum, maximum, and average values of the selected input parameters, and R_{max}, R_{min}, and R are the simulation results for I_{max}, I_{min}, and I, respectively. A larger SI value indicates that the simulation results are more sensitive to the selected parameters.

Table S2. Sensitivity analysis of model response to climate change.

Input parameters	Baseline	Variation Range	CK	P	B
Air temperature (ºC)	13.96	9.78- 18.15	0.02	-0.04	-0.01
Precipitation (mm)	601.40	420.98- 781.82	0.98	0.31	0.34